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REPORT NO. 92-R-03
AFPEA PROJECT NO. 91-P-119

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FIRST ARTICLE TEST AND EVALUATION
M-16 WEAPONS CONTAINER

HQ AFMC/LGTPM
AIR FORCE PACKAGING EVALUATION ACTIVITY
WRIGHT-PATTERSON AFB, OH 45433-5999
DECEMBER 1992

PROJECT NO. 92-P-119
TITLE: First Article Test and Evaluation of M-16 Weapons Container

ABSTRACT

A new contract, F09603-91-C-0942, with first article testing requirements, was awarded for procurement of additional M-16 Weapons Containers. WR-ALC/DSTD requested testing assistance from the Air Force Packaging Evaluation Activity (AFPEA). The container consists of a cover and base each of which are designed to hold six M-16 Rifles (total of 12 rifles per container).

The qualification test series was derived from the previous M-16 Weapons Container Test Plan and consisted of tests from MIL-STD-648A, MIL-C-5584D, and FED-STD-101C.

The test series was performed at the Air Force Packaging Evaluation Activity, Wright-Patterson AFB, Ohio.

PREPARED BY:

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Mechanical Engineer
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PUBLICATION DATE:

30 DEC 1992

REVIEWED BY:

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INTRODUCTION

A new contract, F09603-91-C-0942, with first article testing requirements, was awarded for procurement of additional M-16 Weapons Containers. WR-ALC/DSTD requested testing assistance from the Air Force Packaging Evaluation Activity (AFPEA). Testing was required to be equivalent to the first article production qualification testing previously performed by AFPEA.

An internal design configuration change had been made to the container since the last first article test series. The container can now store the submachine gun version of the M-16 Rifle.

CONTAINER DESCRIPTION

The M-16 Weapons Container is an olive drab color polyethylene rotomolded container. Maximum outer container dimensions are 44 inches length, 24 inches width, and 17.5 inches depth.

The container consists of a cover and base each of which are designed to hold six M-16 Rifles (total of 12 rifles per container). A polyethylene retaining bar, with two metal locking bars, secure the rifles in the cover and base. Each retaining bar (two per container) is secured by a metal cable to each container half. The container tested and 12 simulated M-16 Rifles were provided by WR-ALC/DSTD.

TEST PROCEDURE

The AFPEA M-16 Weapons Container Test Plan, dated 22 Apr 85, Project No. 84-P-142, was reviewed. The M-16 Weapons Container was tested in accordance with the AFPEA M-16 Weapons Container Test Plan, dated 15 Jul 92, Project Number 91-P-119. This test plan referenced MIL-C-5584D, MIL-STD-648A, and FED-STD-101C.

The test methods establish test procedures and container performance criteria. The tests are commonly applied to special shipping containers providing shock and vibration protection to sensitive items. The tests were performed at AFPEA, Wright-Patterson Air Force Base, Ohio 45433.

The container was inspected for exterior damage after each test sequence. The container was then opened and inspected for internal container and rifle damage.

CONTAINER FACE IDENTIFICATION

The correlation between numbered and designated container faces or sides is as follows (Figure 1):

Numbered Side	Designated Side
1	Top
2	Forward (Humidity Indicator)
3	Bottom
4	Aft
5	Left
6	Right

TEST SEQUENCES

TEST SEQUENCE 1 - MIL-C-5584D, 4.7.1, Examination of Product, and 4.8, Inspection of Packaging.

Visual inspection was made of the actual container (Figures 2 and 3). The container was equipped with a pressure relief valve, humidity indicator, four long bail handles (two on cover and two on base, each side), and 14 low profile winglock catch/strike latches. Cartridge and desiccant straps were located on the container base only.

The container color was not uniform with lighter shade olive drab patches noted in the following areas: Face 3 (center), Line 1-4 (center), and near corners 1-2-5 and 1-4-5.

Finish, marking, identification, installation instructions, workmanship, drawings, and inspection of packaging was not examined.

Empty container weight was 71.25 pounds. One M-16 Rifle weighted seven pounds. Total container weight with 12 M-16 Rifles was 155.25 pounds.

The 12 M-16 Rifles were placed in the container base and cover (Figure 4). Rifles could be inserted and removed from the container. The retaining and locking bars secured the rifles in the cover and base. This demonstrated interface compatibility between the rifles and container. Operation of the cartridge and desiccant straps, latches, handles, and pressure relief valve was accomplished.

TEST SEQUENCE 2 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Equipment	Manufacturer	Model	Ser#	Cal Exp
Digital Manometer	Yokogawa	26555-22	82DJ6009	11JUN93
Vacuum/Pressure Pump	Gast Mfg	MOA-P109-AA	0485	N/A

The container pressure relief valve was removed and the relief valve hole used for attachment of the pressure and manometer lines. The container was loaded with the rifles and closed. The leak tests were conducted in accordance with FED-STD-101C, Method 5009.3 at ambient temperature.

The pneumatic pressure leak technique (Figure 5) was utilized and the container pressurized to 0.50 pounds per square inch (psi). The container leak rate for 30 minutes was 0.016 psi (0.032 psi/hour (hr)) which was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

The vacuum retention leak technique was utilized and the container evacuated to 0.50 psi. The container leak rate for 30 minutes was 0.0165 psi (0.033 psi/hr) which was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

The container humidity and pressure relief valve counterbore diameters are 1.94 inch. This diameter did not allow easy insertion of a wrench to tighten each nut.

TEST SEQUENCE 3 & 5 - FED-STD-101C, Method 5007.1, 6.3, Procedures B & E, Free Fall Drop Test.

Equipment	Manufacturer	Model	Ser#	Cal Exp
Environment Chamber	Tenney Eng		BH1138	20JUL92
Drop Tester	L.A.B.	AD-160	1064018	N/A

The free fall drop tests were conducted in accordance with FED-STD-101C, Method 5007.1. The container and rifles were conditioned at -40^0 F (Test Sequence 3) and $+140^0$ F (Test Sequence 5) for 24 hours and then transported to the Conditioning Laboratory to be released from the drop tester.

The container was dropped 16 inches onto the drop tester steel plate. One drop was made on each (six) face (Procedure B, Figure 6) and each (eight) corner (Procedure E, Figure 7) for a

total of 14 drops per conditioning temperature.

Visual inspection revealed cuts on the exterior container surface from the drop tester container platform during handling. There was no damage to the handles and the latches remained closed after the drops. There was no damage to the M-16 Rifles and no container distortion.

TEST SEQUENCE 4 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 2.

A pneumatic pressure test was performed at ambient temperature between Test Sequences 3 and 5. The container leak rate was 0.035 psi/hr which was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCE 6 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 2.

The container leak rate was 0.048 psi/hr (pneumatic pressure test) which was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCE 7 - FED-STD-101C, Method 5016.1, Superimposed-Load Test (Stackability, With Dunnage), MIL-STD-648A, 5.7.2, Load Test (Stackability), and MIL-C-5584D, 4.7.6.1, Load Resistance.

Equipment	Manufacturer	Model	Ser#	Cal Exp
Environment Chamber	Envirotronics		A088843	N/A
Forklift Truck 4000 lb	Mercury	4018	117774	N/A

The test was conducted in accordance with FED-STD-101C, Method 5016.1.

The container containing the 12 M-16 Rifles was placed on the flat, level, rigid chamber floor plates. Another M-16 Weapons Container base and a plywood board was used as dunnage to distribute the load. A 1444 pound load (including plywood and base) was applied to the container top to simulate a stacking load (Figure 8).

The test was conducted at 120^0 F and 90 percent relative humidity

for 168 hours. A visual inspection of the container was made when the load was removed. There was no damage to the M-16 Rifles and no container distortion (Figure 9). The head of a ratchet fastener used to secure a cartridge or desiccant strap sheared off for no apparent reason (Figure 10).

TEST SEQUENCE 8 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 2.

A stiff metal cable secures the polyethylene retaining bar to each container half. A cable become caught in the container gasket which did not allow the container to seal properly. This condition is not easily detected as the container latches can still be closed. The container cover was removed and the cable caught in the gasket area was repositioned. The container then sealed. Cables caught in the container gasket could prevent container sealing and allow moisture to enter the container.

The container leak rate was 0.047 psi/hr (pneumatic pressure test) which was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCE 9 - MIL-STD-648A, 5.2.2, Repetitive Shock Test, FED-STD-101C Method 5019.1, Vibration (Repetitive Shock) Test, and MIL-C-5584D, 4.7.7.3, Repetitive Shock (Superimposed Loads).

Equipment	Manufacturer	Model	Ser#	Cal Exp
Vibration Machine	L.A.B. Div	5000-96B	56801	N/A

The test was conducted in accordance with FED-STD-101C, Method 5019.1, at ambient temperature.

The container with 12 M-16 Rifles was placed on the vibration table (Figure 11). Restraints were utilized that would prevent the container from sliding off the table. The container was allowed unrestricted movement from the centered position on the table about 1/2 inch in any horizontal direction.

The table frequency was increased from 0.0 Hertz (Hz) until the container left the table surface. At 4.5 Hz input vibration frequency, one inch double amplitude, a 1/16 inch thick bar could be slid freely between table and container under all points of the container. This condition was maintained for a period of two hours.

Visual inspection revealed no damage to the container or the M-16 Rifles.

TEST SEQUENCE 10 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 2.

The container leak rate was 0.045 psi/hr (pneumatic pressure test) which was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCE 11 - MIL-C-5584D, 4.7.4.1, Handle Strength Test.

Equipment	Manufacturer	Model	Ser#	Cal Exp
Hoist	Coffing	3 Ton	SRD-112-CP	N/A

The container cover with its rifles was loaded with an additional 187.5 pounds load for a total gross weight of 250 pounds. One container cover handle was lifted by a chain hoist and held completely above the ground for five minutes at ambient temperature (Figure 12). No deformation of the container cover handle or its supporting structure was noted.

TEST SEQUENCE 12 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 2.

The container leak rate was 0.035 psi/hr (pneumatic pressure test) which was within the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

CONCLUSIONS

The M-16 Weapons Container provided protection for the simulated M-16 Rifles used for this test series when tested in accordance with the container test plan.

APPENDIX 1

PHOTOGRAPHS

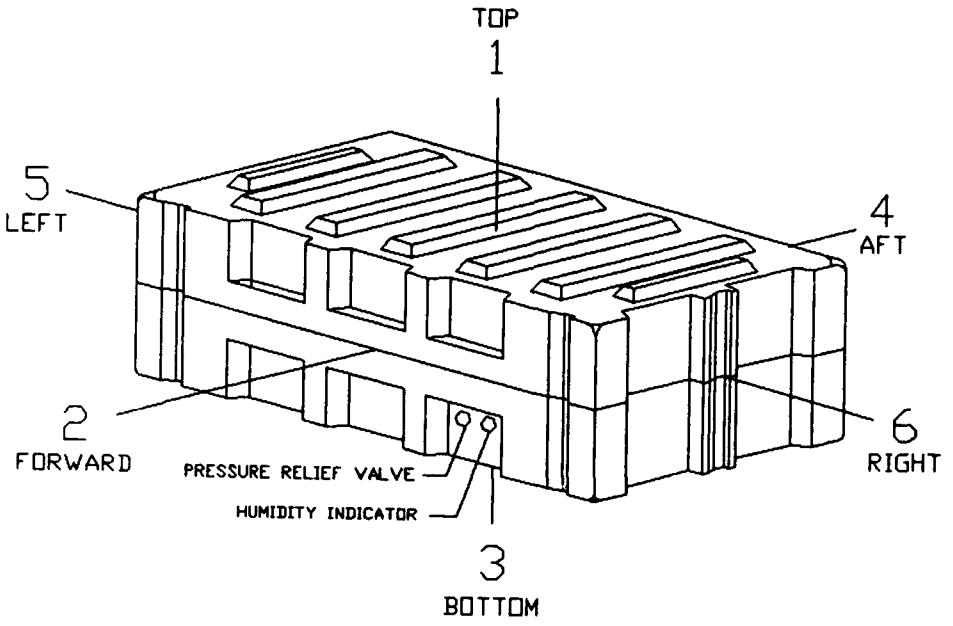

Figure 1. Container Side Designations

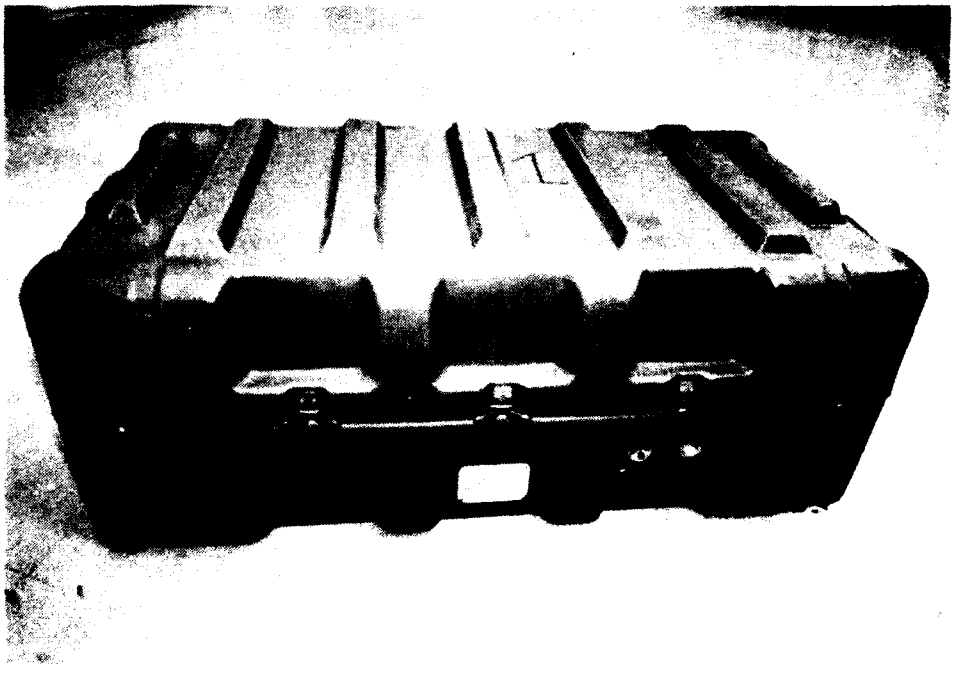

Figure 2. Container Exterior

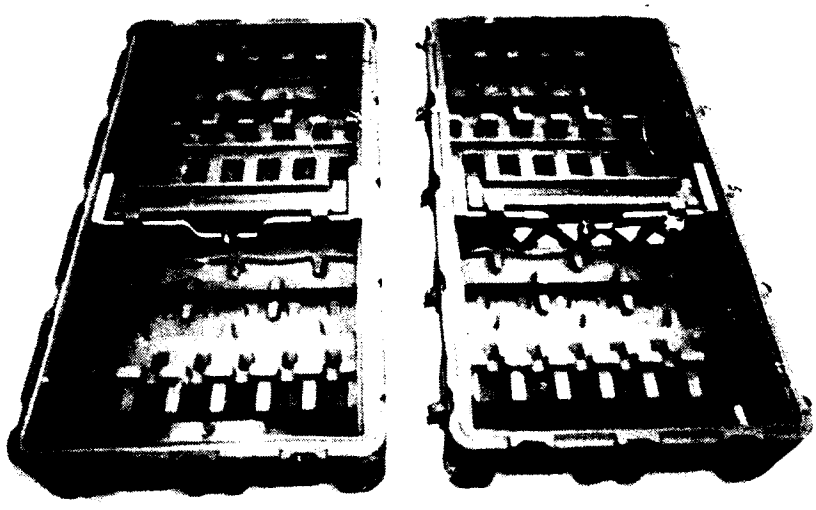

Figure 3. Container Interior

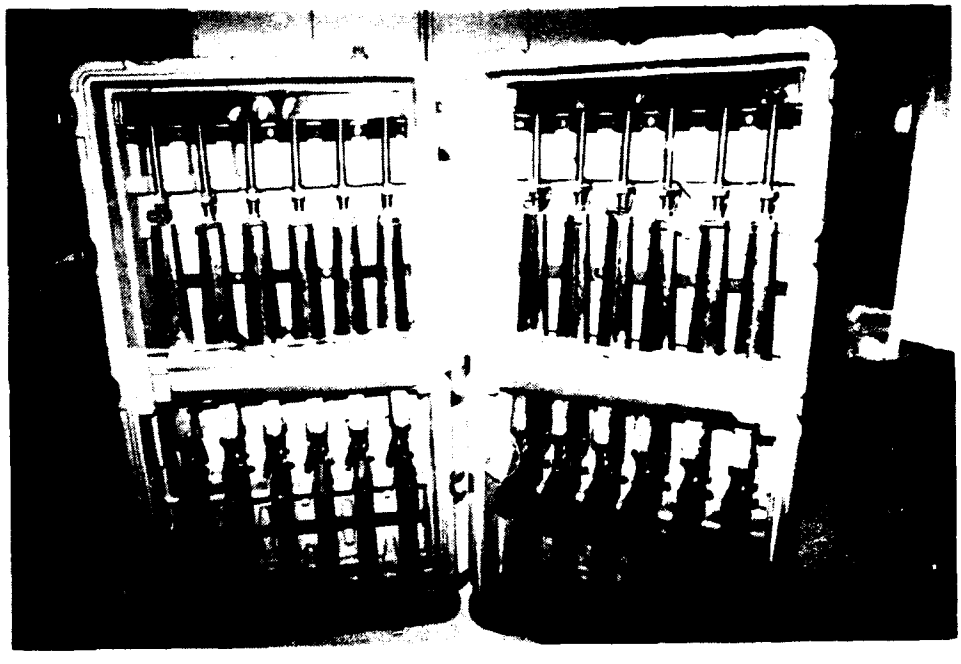

Figure 4. M-16 Rifles Secured in Container

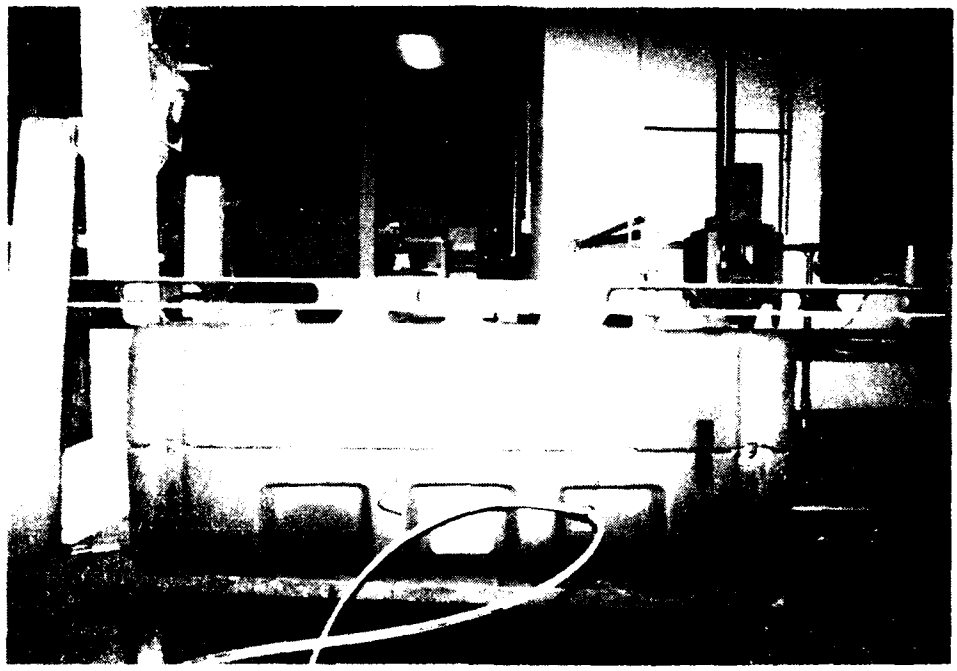

Figure 5. Pneumatic Pressure/Vacuum Retention Leak Test

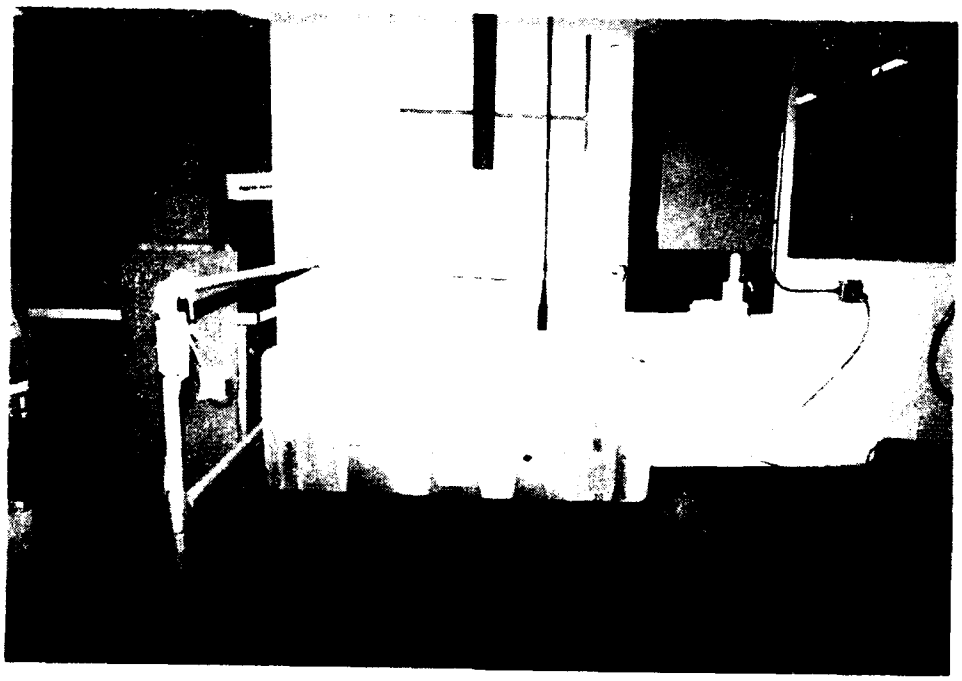

Figure 6. Flat Face Drop Test

Figure 7. Cornerwise Drop Test

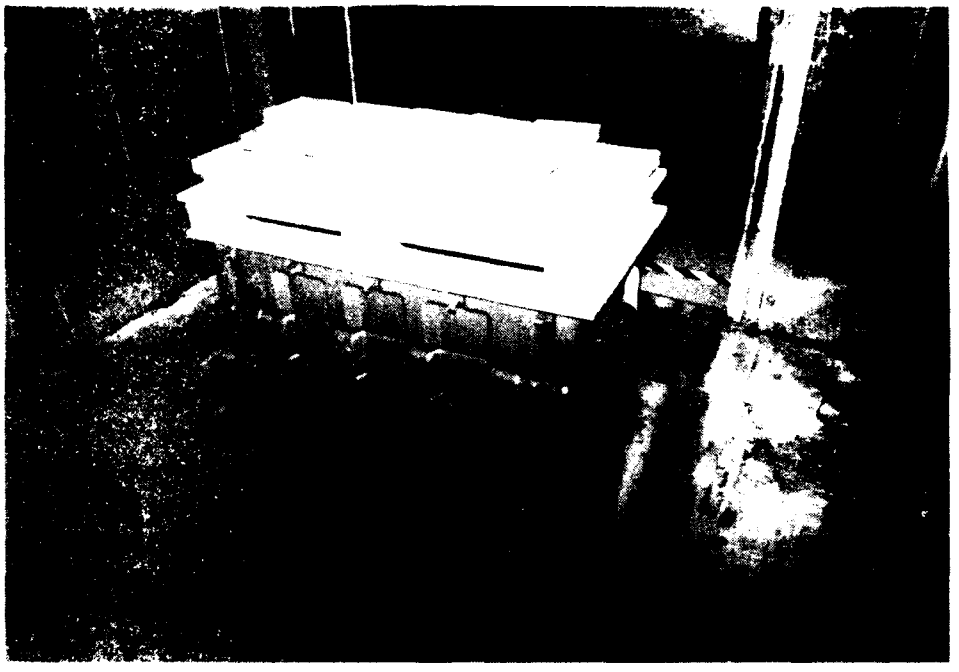

Figure 8. Superimposed-Load Test

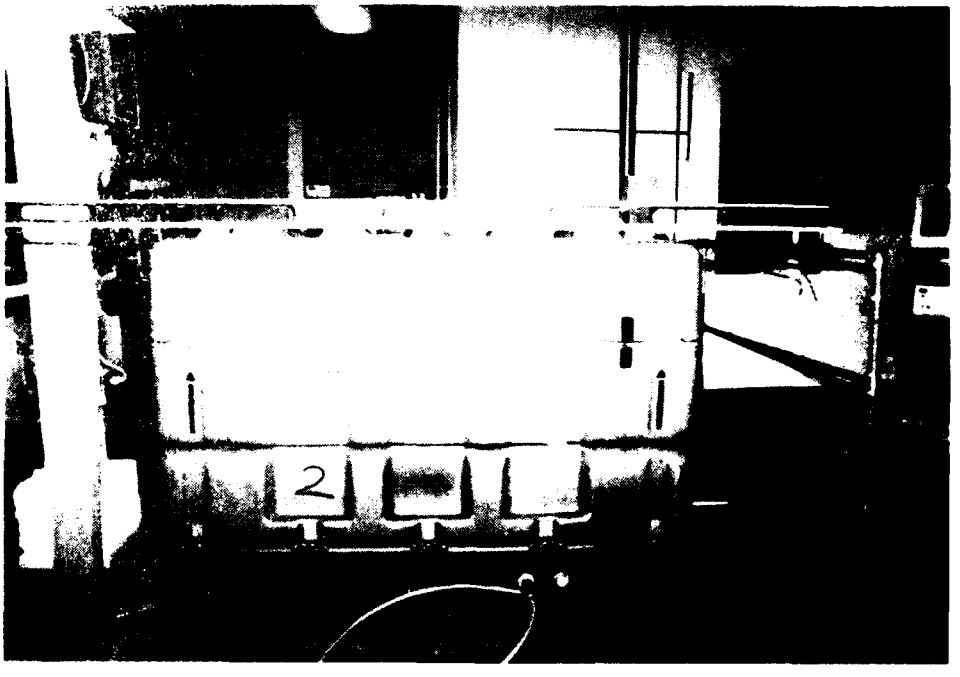

Figure 9. Check for Container Distortion

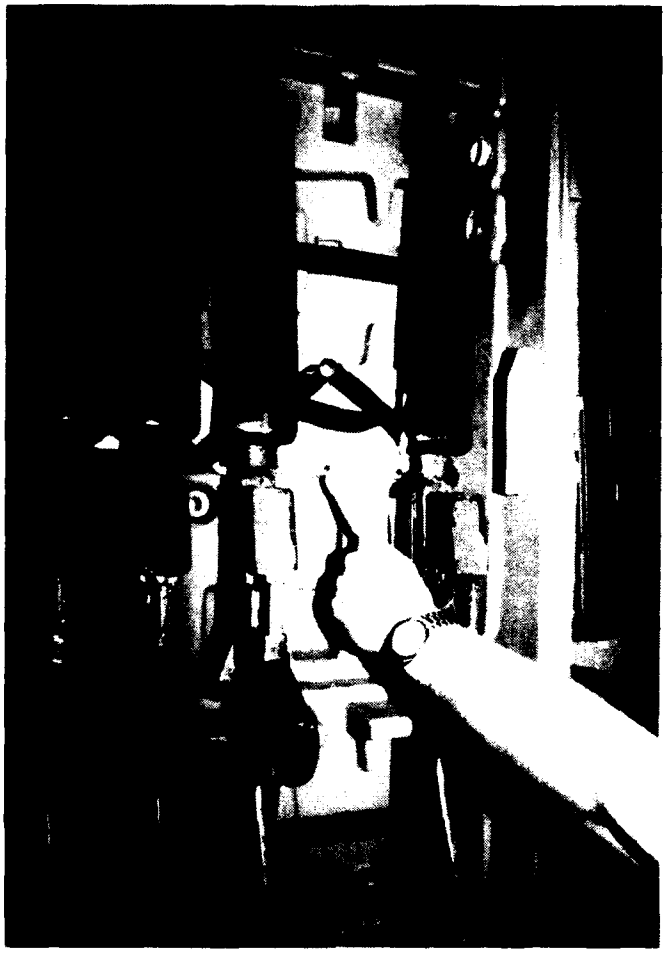

Figure 10. Ratchet Fastener Failure

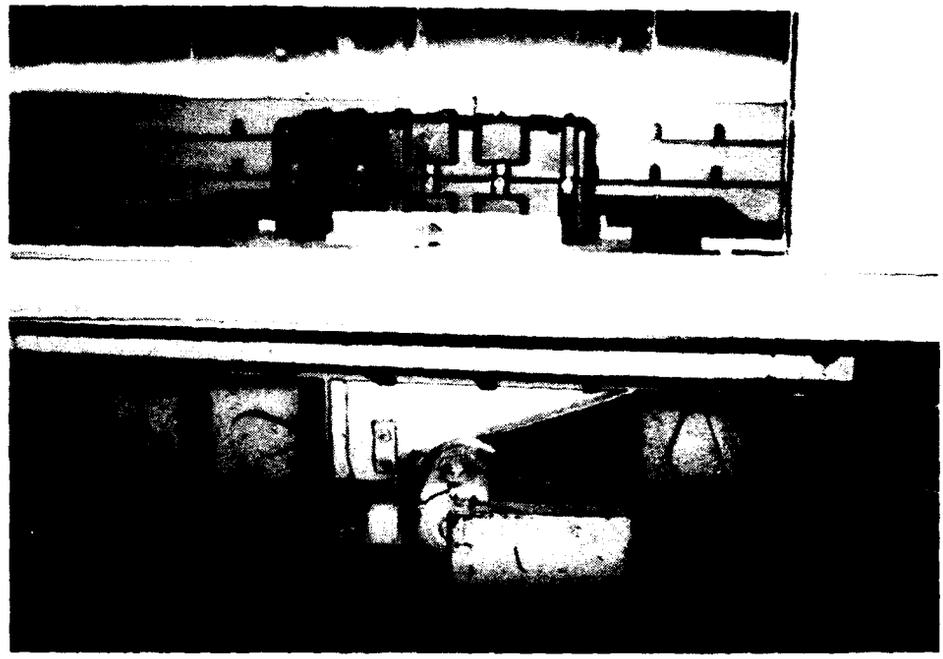

Figure 11. Repetitive Shock Test

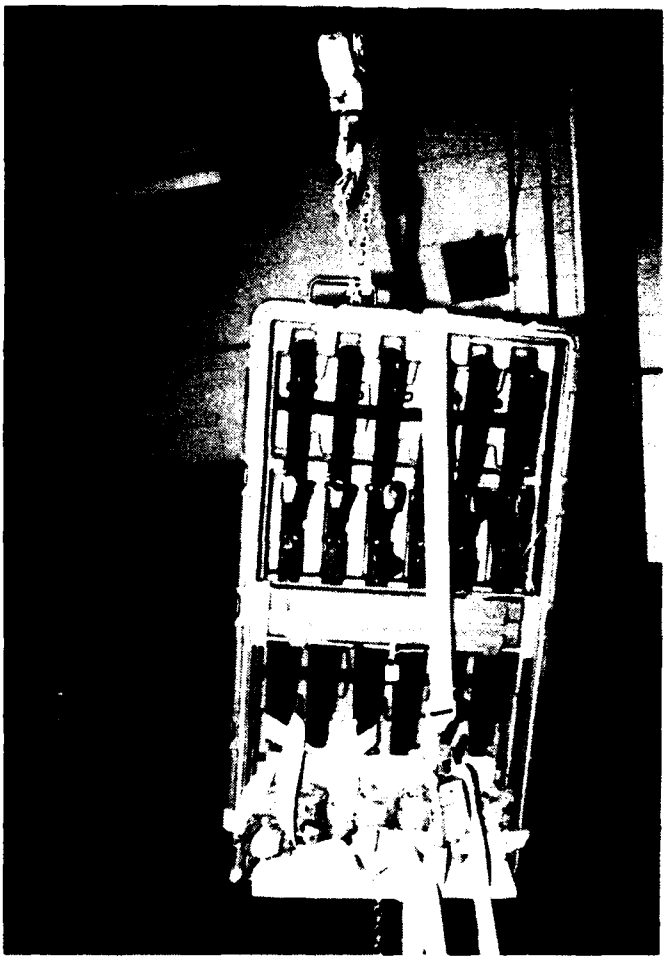

Figure 12. Handle Strength Test

APPENDIX 2

TEST PLAN

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER: 91-P-119

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
	43"x 24"x 17.5"	168	108	10.45	2	15 Jul 92

ITEM NAME: M-16 Rifle

MANUFACTURER: Hardigg Industries, Inc.

CONTAINER NAME: M-16 Weapon Container

CONTAINER COST: N/A

PACK DESCRIPTION: Polyethylene Rotomolded Case

CONDITIONING: Ambient or as specified in test.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
1.	**INSPECTION**	Visual inspection of container before start of test.	Fully assembled container.	Visual Inspection
2.	**LEAK TEST**			
	FED-STD-101 METHOD 5009.3	Pneumatic pressure at 0.50 PSIG and vacuum retention at 0.50 PSIG. Test duration to be a minimum of 30 minutes with 0.025 PSIG loss allowed after temp-erature stabilization	Test at ambient condition from compressed air supply/vacuum pump.	Water manometer
3.	**FREE-FALL DROP TEST**			
	FED-STD-101 Method 5007.1 Procedure B and E	Condition at -40^0F for not less than 24 hours. Drop height 16 inches, 14 drops.	Test performed in chamber. One drop on 6 faces, and 8 corners for a total of 14 drops	Chamber/ hoist
4.	**REPEAT TEST 2**			

COMMENTS:

PREPARED BY: KEITH VOSSLER, Mechanical Engineer

APPROVED BY: LARRY WOOD, Chief, Matl. Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER: 91-P-119

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
43"x 24"x 17.5"	168	108		10.45	2	15 Jul 92

ITEM NAME: M-16 Rifle

MANUFACTURER: Hardigg Industries, Inc.

CONTAINER NAME: M-16 Weapon Container

CONTAINER COST: N/A

PACK DESCRIPTION: Polyethylene Rotomolded Case

CONDITIONING: Ambient or as specified in test.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
5.	**FREE-FALL DROP TEST**			
	FED-STD-101 Method 5007.1 Procedure B and E	Condition at +140^{0}F for not less than 24 hours. Drop height 16 inches, 14 drops.	Test performed in chamber. One drop on 6 faces, and 8 corners, for a total of 4 drops	Chamber/ hoist
6.	**REPEAT TEST 2**			
7.	**SUPERIMPOSED LOAD**			
	FED-STD-101 Method 5016.1	At ambient temperature, stack two containers with additional load on top to simulate stacking 8 loaded containers. Load equals load on bottom container times a factor of safety of 1 (1440 lbs). Condition the containers at 120^{0}F and 90% relative humidity for 168 hours. The additional load placed on top container is such that the total load is carried by the stacking provisions. There shall be no permanent deformation.	Test conducted in chamber. Stack two high, bottom container is under test.	Visual inspection

COMMENTS:

PREPARED BY: KEITH VOSSLER, Mechanical Engineer

APPROVED BY: LARRY WOOD, Chief, Matl. Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER: 91-P-119

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
	43"x 24"x 17.5"	168	108	10.45	2	15 Jul 92

ITEM NAME: M-16 Rifle

MANUFACTURER: Hardigg Industries, Inc.

CONTAINER NAME: M-16 Weapon Container

CONTAINER COST: N/A

PACK DESCRIPTION: Polyethylene Rotomolded Case

CONDITIONING: Ambient or as specified in test.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRUMENTATION
8.	**REPEAT TEST 2**			
9.	**VIBRATION (REPETITIVE SHOCK/TEST)**			
	MIL-STD-648 Section 5.2.2 FED-STD-101 Section 5019.1	3 to 5 (Hz) or 1G which-ever is less for not less than 2.0 hours.	Normal position Ambient	Vibration table Triaxial accelero-meter
10.	**REPEAT TEST 2**			
11.	**COVER HANDLE PULL TEST**			
		Apply a force of 250 lbs on a cover handle in all directions that service loads are possible. There shall be no damage or permanent deform-ation.	Ambient	Scale
12.	**REPEAT TEST 2**			

COMMENTS:

PREPARED BY: KEITH VOSSLER, Mechanical Engineer

APPROVED BY: LARRY WOOD, Chief, Matl. Br., AFPEA

APPENDIX 3

DISTRIBUTION LIST

DISTRIBUTION LIST

DTIC/FDAC CAMERON STATION ALEXANDRIA VA 22304-6145	12
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OC-ALC/DST TINKER AFB OK 73145-5000	1
OC-ALC/DSTD TINKER AFB OK 73145-5000	1
OO-ALC/TID HILL AFB UT 84056-5000	1
OO-ALC/TIDTL HILL AFB UT 84406	1
SA-ALC/DST KELLY AFB TX 78241	1
SA-ALC/DSTD KELLY AFB TX 78241	1
SM-ALC/TID MCCLELLAN AFB CA 95652-5000	1
SM-ALC/TIDTD MCCLELLAN AFB CA 95652-5000	1
SM-ALC/TIDTL MCCLELLAN AFB CA 95652-5000	1
WR-ALC/DST ROBINS AFB GA 31098-5000	1
WR-ALC/DSTD ROBINS AFB GA 31098-5000	1

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RICHMOND VA 23297-5000

APPENDIX 4

REPORT DOCUMENTATION

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY None	3. DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release distribution unlimited
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) Air Force Packaging Evaluation Activity 92-R-03	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Air Force Packaging Evaluation Activity 6b. OFFICE SYMBOL (If applicable) HQ AFMC/LGTP	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) HQ AFMC/LGTP Wright-Patterson AFB OH 45433-5999	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING / SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
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A new contract, with first article testing requirements, was awarded for procurement of additional M-16 Weapons Containers. WR-ALC/DSTD requested testing assistance from the Air Force Packaging Evaluation Activity (AFPEA). The container consists of a cover and base each of which are designed to hold six M-16 Rifles (total of 12 rifles per container).

The qualification test series was derived from the previous M-16 Weapons Container Test Plan and consisted of tests from MIL-STD-648A, MIL-C-5584D, and FED-STD-101C.

The test series was performed at the Air Force Packaging Evaluation Activity, Wright-Patterson AFB OH.

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